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EXAMINER
PAREKH, NITIN

ART UNIT	PAPER NUMBER
2811	

DATE MAILED: 09/25/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/742,366	KHAN ET AL.	
	Examiner	Art Unit	
	Nitin Parekh	2811	

-- The MAILING DATE of this communication appears on the c ver sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *18 June 2003* .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *14,18-22,60 and 63-87* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *4,18-22,60 and 63-87* is/are rejected.

7)☒ Claim(s) *15-17* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *11 October 2002* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) *18* .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other:

DETAILED ACTION

Information Disclosure Statement

1. The Information Disclosure Statements filed on 01-31-02, 05-09-02, 10-11-02 and 06-18-03 have been considered.

Claim Objections

2. Claims 15-17 are objected to because of the following informalities:

A. Claims 15-17 have been previously canceled (see paper no. 10). Therefore, claims 15-17 should be identified as "canceled" instead of "currently amended".

Appropriate correction is required.

Claim Rejections - 35 USC § 102

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

4. Claims 63, 66, 67, 70, 73, 74, 77, 82, 84 and 86 are rejected under 35 U.S.C. 102(b) as being anticipated by Nakashima et al. (US Pat. 5717252).

Regarding claim 63, Nakashima et al. disclose a ball grid (BGA) package (Fig. 21) comprising:

- a substrate such as an insulating tape/tape automated bonding (TAB) substrate (2 in Fig. 21; Col. 14, line 50) having a first/top and a second surface/bottom
- a metal plate/substrate/stiffener (4 in Fig. 21; Col. 15, line 64) having a first/top and a second/bottom surface, the metal substrate/stiffener providing enhanced support and strengthening/stiffening functions and an improved reliability (Col. 5, line 5, Col. 6, line 44)
- a portion of the second/bottom surface of the metal plate/stiffener being attached to the first/top surface of the substrate/TAB substrate of the BGA package , wherein the metal plate/stiffener has a plurality of openings/holes formed therethrough (21a in Fig. 21; Col. 14, line 62) that are each open at the first/top and second/bottom surfaces
- an integrated circuit (IC) die (3 in Fig. 21) being mounted on the first/top surface of the metal plate/stiffener
- a plurality of solder balls (5 in Fig. 21; Col. 14, line 52) being attached to the second/bottom surface of the substrate/TAB substrate
- the substrate/TAB substrate having a window/window--shaped opening (not numerically referenced- see the central opening in 2 in Fig. 21)

- the metal substrate/stiffener having a centrally located cavity shaped portion protruding through the window opening of the substrate/TAB substrate such that a portion of the second/bottom surface of the metal plate/stiffener is exposed (see a central portion of 4 with respect to the opening in 2 in Fig. 21; Col. 15, line 67), and
- a plurality of wire bonds (see the bonding wire 7 for respective hole 21a in Fig. 21) being attached to the IC die and to the first/top surface of the substrate/TAB substrate through the plurality of respective openings

(Fig. 21; Col. 15, line 61- Col. 16, line 5; Col. 14, line 14- Col. 15, line 8).

Regarding claims 66 and 67, Nakashima et al. teach substantially the entire claimed structure as applied to claim 63 above, wherein Nakashima et al., teach the IC die (3 in Fig. 21) being mounted on the first/top surface of the metal plate/stiffener in the cavity shaped portion of the metal plate/stiffener.

Regarding claim 70, Nakashima et al. disclose a ball grid (BGA) package (Fig. 21) comprising:

- a substrate such as an insulating tape/tape automated bonding (TAB) substrate (2 in Fig. 21; Col. 14, line 50) having a first/top and a second surface/bottom

- a metal plate/substrate/stiffener (4 in Fig. 21; Col. 15, line 64) having a first/top and a second/bottom surface, the metal substrate/stiffener providing enhanced support and strengthening/stiffening functions and an improved reliability (Col. 5, line 5, Col. 6, line 44)
- a portion of the second/bottom surface of the metal plate/stiffener being attached to the first/top surface of the substrate/TAB substrate and substantially covering the first/top surface of the substrate/TAB substrate (see Fig. 21), wherein the metal plate/stiffener has a plurality of openings/holes formed therethrough (21a in Fig. 21; Col. 14, line 62) that are each open at the first/top and second/bottom surfaces
- an integrated circuit (IC) die (3 in Fig. 21) being mounted on the first/top surface of the metal plate/stiffener
- a plurality of solder balls (5 in Fig. 21; Col. 14, line 52) being attached to the second/bottom surface of the substrate/TAB substrate
- the substrate/TAB substrate having a window/window--shaped opening (not numerically referenced- see the central opening in 2 in Fig. 21)
- the metal substrate/stiffener having a centrally located cavity shaped portion protruding through the window opening of the substrate/TAB substrate such that a portion of the second/bottom surface of the metal plate/stiffener is exposed (see a central portion of 4 with respect to the opening in 2 in Fig. 21; Col. 15, line 67), and

- a plurality of wire bonds (see the bonding wire 7 for respective hole 21a in Fig. 21; Col. 14, line 62) being attached to the IC die and to the first/top surface of the substrate/TAB substrate through the plurality of respective openings

(Fig. 21; Col. 15, line 61- Col. 16, line 5; Col. 14, line 14- Col. 15, line 8).

Regarding claims 73 and 74, Nakashima et al. teach substantially the entire claimed structure as applied to claim 70 above, wherein Nakashima et al., teach the IC die being mounted on the first/top surface of the metal plate/stiffener in the cavity shaped portion of the metal plate/stiffener (Fig. 21).

Regarding claim 77, Nakashima et al. disclose a ball grid (BGA) package (Fig. 21) having a comprising:

- a BGA package substrate such as an insulating tape/tape automated bonding (TAB) substrate (2 in Fig. 21; Col. 14, line 50) having a first/top and a second surface/bottom
- a metal plate/substrate/stiffener (4 in Fig. 21; Col. 15, line 64) having a first/top and a second/bottom surface, the metal substrate/stiffener providing enhanced support and strengthening/stiffening functions and an improved reliability (Col. 5, line 5, Col. 6, line 44)

- a portion of the second/bottom surface of the metal plate/stiffener being attached to the first/top surface of the BGA package substrate/TAB substrate, and substantially covering the first/top surface of the BGA package substrate/TAB substrate (see Fig. 21), wherein the metal plate/stiffener has a plurality of openings/holes formed therethrough (21a in Fig. 21; Col. 14, line 62) that are each open at the first/top and second/bottom surfaces
- an integrated circuit (IC) die (3 in Fig. 21) being mounted on the first/top surface of the metal plate/stiffener
- a plurality of solder balls (5 in Fig. 21; Col. 14, line 52) attached to the second/bottom surface of the substrate/TAB substrate
- the BGA package substrate/TAB substrate having a window/window-shaped opening (not numerically referenced- see the central opening in 2 in Fig. 21)
- the metal substrate/stiffener having a centrally located cavity shaped portion protruding through the window opening of the BGA package substrate/TAB substrate such that a portion of the second/bottom surface of the metal plate/stiffener is exposed (see a central portion of 4 with respect to the opening in 2 in Fig. 21; Col. 15, line 67), and
- a plurality of wire bonds (see a bonding wire 7 for the respective opening 21a in Fig. 21) being attached to the IC die and to the first/top surface of the BGA package substrate/TAB substrate through the plurality of openings

(Fig. 21; Col. 15, line 61- Col. 16, line 5; Col. 14, line 14- Col. 15, line 8).

Regarding claims 82, Nakashima et al. teach substantially the entire claimed structure as applied to claim 63 above, wherein Nakashima et al., teach the second surface of the metal plate/stiffener substantially covering the first surface of the substrate/TAB substrate to which the metal plate/stiffener is attached (Fig. 21).

Regarding claim 84, Nakashima et al. teach substantially the entire claimed structure as applied to claim 70 above, wherein Nakashima et al., teach the metal plate/stiffener substantially covering the surface of the substrate/TAB substrate to which the metal plate/stiffener is attached (Fig. 21).

Regarding claims 86, Nakashima et al. teach substantially the entire claimed structure as applied to claim 77 above, wherein Nakashima et al., teach the second surface of the metal plate/stiffener substantially covering the first surface of the BGA substrate/TAB substrate to which the metal plate/stiffener is attached (Fig. 21).

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

6. Claims 68, 69, 75, 76, 83, 85 and 87 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nakashima et al. (US Pat. 5717252) in view of Karnezos (US Pat. 6020637).

Regarding claims 68 and 69, Nakashima et al. teach substantially the entire claimed structure as applied to claims 63 and 66 above, except the IC die having a surface including a ground or a power signal pad and a wire bond coupling the ground or power signal pads to the first surface of the stiffener respectively.

Karnezos teaches a BGA package where an IC having a plurality of bonding wires (12 and 2626'/26" in Fig. 2) and die pads including power and ground pads (not numerically referenced in Fig. 2) are coupled to a stiffener/heat spreader (10 in Fig. 2) such that a bonding wire corresponding to a ground ring connection on the first surface of the stiffener/heat spreader is coupled to respective die pad/ground pad (26"/21 in Fig. 2; Col. 2, line 30-40) while additional wire bonds (26' in Fig. 2) are being used to provide the desired signal/power connections for the corresponding die pads to the substrate (Col. 2, lines 17-52).

It would have been obvious to a person of ordinary skill in the art at the time invention was made to incorporate the IC die having a surface including a ground or power signal pad and a wire bond coupling the ground or power signal pad to the first surface of the stiffener respectively as taught by Karnezos so that the power/ground routing and thermal dissipation can be improved in Nakashima et al's BGA package.

Regarding claims 75 and 76, Nakashima et al. teach substantially the entire claimed structure as applied to claims 70 and 73 above, except the IC die having a surface including a ground or a power signal pad and a wire bond coupling the ground or power signal pad to the first surface of the stiffener respectively.

Karnezos teaches a BGA package where an IC having a plurality of bonding wires (12 and 26'/26" respectively in Fig. 2) and die pads including power and ground pads (not numerically referenced in Fig. 2) are coupled to a stiffener/heat spreader (10 in Fig. 2) such that a bonding wire corresponding to a ground ring connection on the first surface of the stiffener/heat spreader is coupled to respective die pad/ground pad (26"/21 in Fig. 2; Col. 2, line 30-40) while additional wire bonds (26' in Fig. 2) are being used to provide the desired signal/power connections for the corresponding die pads to the substrate (Col. 2, lines 17-52).

It would have been obvious to a person of ordinary skill in the art at the time invention was made to incorporate the IC die having a surface including a ground or power signal pad and a wire bond coupling the ground or power signal pad to the first surface of the stiffener respectively as taught by Karnezos so that the power/ground routing and thermal dissipation can be improved in Higgins, III and Nakashima et al's BGA package.

Regarding claim 83, Nakashima et al. teach substantially the entire claimed structure as applied to claims 63 and 82 above, except the outer edges of the stiffener being substantially even with those of the substrate.

Karnezos teaches a BGA package configuration having an IC die (12 in Fig. 2) being mounted on the heat spreader/stiffener-tape substrate (10 and 16/25 in Fig. 2 respectively) assembly where outer edges of the heat spreader/stiffener are substantially even with those of the tape substrate (Col. 2, lines 17-52).

It would have been obvious to a person of ordinary skill in the art at the time invention was made to incorporate except the outer edges of the stiffener being substantially even with those of the as taught by Karnezos so that an exterior surface protection and resin molding/encapsulation can be improved in Nakashima et al's BGA package.

Regarding claim 85, Nakashima et al. teach substantially the entire claimed structure as applied to claims 70 and 84 above, except the outer edges of the stiffener being substantially even with those of the substrate.

Karnezos teaches a BGA package configuration having an IC die (12 in Fig. 2) being mounted on the heat spreader/stiffener-tape substrate (10 and 16/25 in Fig. 2 respectively) assembly where outer edges of the heat spreader/stiffener are substantially even with those of the tape substrate (Col. 2, lines 17-52).

It would have been obvious to a person of ordinary skill in the art at the time invention was made to incorporate except the outer edges of the stiffener being

substantially even with those of the as taught by Karnezos so that an exterior surface protection and resin molding/encapsulation can be improved in Nakashima et al's BGA package.

Regarding claim 87, Nakashima et al. teach substantially the entire claimed structure as applied to claims 77 and 86 above, except the outer edges of the stiffener being substantially even with those of the substrate.

Karnezos teaches a BGA package configuration having an IC die (12 in Fig. 2) being mounted on the heat spreader/stiffener-tape substrate (10 and 16/25 in Fig. 2 respectively) assembly where outer edges of the heat spreader/stiffener are substantially even with those of the tape substrate (Col. 2, lines 17-52).

It would have been obvious to a person of ordinary skill in the art at the time invention was made to incorporate except the outer edges of the stiffener being substantially even with those of the as taught by Karnezos so that an exterior surface protection and resin molding/encapsulation can be improved in Nakashima et al's BGA package.

7. Claims 65 and 72 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nakashima et al. (US Pat. 5717252) in view of Higgins, III (US Pat. 5583377). 5291062).

Regarding claim 65, Nakashima et al. teach substantially the entire claimed structure as applied to claim 63 above, except the stiffener being coupled to a first potential.

Higgins, III ('377 patent) teaches a stiffener/heat sink being electrically coupled to a ground/first potential/voltage plane to achieve the desired grounding/voltage connection in addition to the thermal dissipation (Col. 9, lines 1-10).

It would have been obvious to a person of ordinary skill in the art at the time invention was made to incorporate the stiffener being coupled to a first potential as taught by Higgins, III so that the desired grounding and voltage connection can be achieved and the thermal conduction can be improved in Higgins, III and Nakashima et al's BGA.

Regarding claim 72, Nakashima et al. teach substantially the entire claimed structure as applied to claim 70 above, except the stiffener being coupled to a first potential.

Higgins, III ('377 patent) teaches the stiffener/heat sink being electrically coupled to a ground/first potential/voltage plane to achieve the desired grounding/voltage connection in addition to the thermal dissipation (Col. 9, lines 1-10).

It would have been obvious to a person of ordinary skill in the art at the time invention was made to incorporate the stiffener being coupled to a first potential as taught by Higgins, III so that the desired grounding and voltage connection can be achieved and the thermal conduction can be improved in Higgins, III and Nakashima et al's BGA.

8. Claims 14, 18-20, 22, 60, 64, 71 and 78-80 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nakashima et al. (US Pat. 5717252) in view of Higgins, III (US Pat. 5583377) and Higgins III (US Pat. 5291062).

Regarding claim 14, Nakashima et al. disclose a ball grid (BGA) package (Fig. 21) comprising:

- a substrate such as an insulating tape/tape automated bonding (TAB) substrate (2 in Fig. 21; Col. 14, line 50) having a first/top and a second surface/bottom
- a metal plate/substrate/stiffener (4 in Fig. 21; Col. 15, line 64) having a first/top and a second/bottom surface, the metal substrate/stiffener providing enhanced support and strengthening/stiffening functions and improved reliability (Col. 5, line 5, Col. 6, line 44)
- a portion of the second/bottom surface of the metal plate/stiffener being attached to the first/top surface of the substrate/TAB substrate and substantially covering the first/top surface (see Fig. 21), wherein the metal plate/stiffener has a plurality of openings/holes formed therethrough (21a in Fig. 21; Col. 14, line 62) that are each open at the first/top and second/bottom surfaces
- an integrated circuit (IC) die (3 in Fig. 21) being mounted on the first/top surface of the metal plate/stiffener

- a plurality of solder balls (5 in Fig. 21; Col. 14, line 52) being attached to the second/bottom surface of the substrate/TAB substrate
- the substrate/TAB substrate having a window opening (not numerically referenced- see the central opening in 2 in Fig. 21)
- the metal substrate/stiffener having a centrally located cavity shaped portion protruding through the window opening of the substrate/TAB substrate such that a portion of the second/bottom surface of the metal plate/stiffener is exposed (see a central portion of 4 with respect to the opening in 2 in Fig. 21; Col. 15, line 67), and
- a plurality of wire bonds (see a bonding wire 7 for the respective opening 21a in Fig. 21) being attached to the IC die and to the first/top surface of the substrate/TAB substrate through the plurality of openings

(Fig. 21; Col. 15, line 61- Col. 16, line 5; Col. 14, line 14- Col. 15, line 8).

Nakashima et al. fail to teach the exposed portion of the metal plate/stiffener being configured to be coupled to a printed circuit board (PCB).

Higgins, III ('377 patent) teaches an exposed portion of a heat sink/stiffener being configured to be coupled/bonded to an user/external substrate (22 and 34 in Fig. 1 respectively; Col. 4, line 65).

Higgins, III ('062 patent) teaches using a conventional mounting substrate such as a board/PCB for providing next level/external connections for a BGA package (Col. 4, line 25-30; Col. 5, line 55).

It would have been obvious to a person of ordinary skill in the art at the time invention was made to incorporate the exposed portion of the stiffener being configured to be coupled to a PCB as taught by Higgins, III ('377 and '062 patents) so that an external connection capability and interconnect density can be improved in Nakashima et al's BGA.

Regarding claim 18, Nakashima et al, Higgins, III ('377 patent) and Higgins, III ('062 patent) teach substantially the entire claimed structure as applied to claim 14 above, wherein Nakashima et al. teach the metal substrate/stiffener having the centrally located cavity shaped portion protruding through the window opening of the substrate/TAB substrate such that the cavity shaped portion forms the exposed of the second/bottom surface of the metal substrate/stiffener.

Regarding claim 19, Nakashima et al, Higgins, III ('377 patent) and Higgins, III ('062 patent) teach substantially the entire claimed structure as applied to claims 14 and 18 above, except the surface of the cavity portion being plated with the solder that allows the stiffener to be surface mounted to at least one soldering pad on the PCB.

Higgins, III ('377 patent) further teaches the exposed surface of the cavity portion of the heat sink/stiffener being coupled/bonded using a solder/plating (36 in Fig. 1) to a soldering pad (35 in Fig. 1) on the user/external substrate (34 in Fig. 1) to improve thermal conduction (Col. 4, lines 56- 67).

Higgins, III ('062 patent) teaches using a conventional mounting substrate such as a board/PCB for providing next level/external connections for a BGA package (Col. 4, line 25-30; Col. 5, line 55).

It would have been obvious to a person of ordinary skill in the art at the time invention was made to incorporate the surface of the cavity portion being plated with the solder that allows the stiffener to be surface mounted to at least one soldering pad on the PCB as taught by Higgins, III ('377 and '062 patents) so that the thermal conduction, bonding strength and the external connection capability can be improved in Nakashima et al's BGA.

Regarding claim 20, Nakashima et al., Higgins, III ('377 patent) and Higgins, III ('062 patent) teach substantially the entire claimed structure as applied to claim 14 above, except the stiffener being coupled to a first potential.

Higgins, III ('377 patent) further teaches the stiffener/heat sink being electrically coupled to a ground/first potential/voltage plane to achieve the desired grounding/voltage connection in addition to the thermal dissipation (Col. 9, lines 1-10).

It would have been obvious to a person of ordinary skill in the art at the time invention was made to incorporate the stiffener being coupled to a first potential as taught by Higgins, III ('377 patent) so that the desired grounding and voltage connection can be achieved and the thermal conduction can be improved in Higgins, III ('062 patent) and Nakashima et al's BGA.

Regarding claim 22, Nakashima et al., Higgins, III ('377 patent) and Higgins, III ('062 patent) teach substantially the entire claimed structure as applied to claim 14 above, wherein Nakashima et al. teach the substrate being the tape substrate.

Regarding claim 60, Nakashima et al., Higgins, III ('377 patent) and Higgins, III ('062 patent) teach substantially the entire claimed structure as applied to claim 14 above, except the substrate being an organic substrate.

Higgins, III ('377 patent) further teach the substrate being made of a variety of conventional material including epoxy/organic/PCB, ceramic, etc. to provide the desired reinforcement and processing capability (Col. 3, line 43- Col. 4, line 7).

It would have been obvious to a person of ordinary skill in the art at the time invention was made to incorporate the organic substrate as taught by Higgins, III ('377 patent) so that the reinforcement, rigidity and thermal conduction can be improved in Higgins, III ('062 patent) and Nakashima et al's BGA.

Regarding claim 64, Nakashima et al. teach substantially the entire claimed structure as applied to claim 63 above, except the exposed portion of second surface of the stiffener being configures to be coupled to a PCB.

Higgins, III ('377 patent) further teaches the exposed surface of the cavity portion of the heat sink/stiffener being coupled/bonded using a solder/plating (36 in Fig. 1) to a soldering pad (35 in Fig. 1) on the user/external substrate (34 in Fig. 1) to improve thermal conduction (Col. 4, lines 56- 67).

Higgins, III ('062 patent) teaches using a conventional mounting substrate such as a board/PCB for providing next level/external connections for a BGA package (Col. 4, line 25-30; Col. 5, line 55).

It would have been obvious to a person of ordinary skill in the art at the time invention was made to incorporate a portion of the second surface is plated with a metal comprising a solder material to facilitate an attachment to a PCB as taught by Higgins, III ('377 and '062 patents) so that the thermal conduction, bonding strength and the external connection capability can be improved in Nakashima et al's BGA.

Regarding claim 71, Nakashima et al. teach substantially the entire claimed structure as applied to claim 70 above, except the exposed portion of the second surface of the stiffener being configured to be coupled to a PCB.

Higgins, III ('377 patent) teaches an exposed portion of a heat sink/stiffener being configured to be coupled/bonded to an user/external substrate (22 and 34 in Fig. 1 respectively; Col. 4, line 65).

Higgins, III ('062 patent) teaches using a conventional mounting substrate such as a board/PCB for providing next level/external connections for a BGA package (Col. 4, line 25-30; Col. 5, line 55).

It would have been obvious to a person of ordinary skill in the art at the time invention was made to incorporate the exposed portion of the stiffener being configured to be coupled to a PCB as taught by Higgins III ('377 and '062 patents) so that an external connection capability and interconnect density can be improved in Nakashima et al's BGA.

Regarding claims 78 and 79, Nakashima et al. teach substantially the entire claimed structure as applied to claim 77 above, except a portion of the second surface is plated with a metal comprising a solder material to facilitate an attachment to a PCB.

Higgins, III ('377 patent) teaches the exposed surface of the cavity portion of the heat sink/stiffener being coupled/bonded using a solder/plating (36 in Fig. 1) to a soldering pad (35 in Fig. 1) on the user/external substrate (34 in Fig. 1) to improve thermal conduction (Col. 4, lines 56- 67).

Higgins, III ('062 patent) teaches using a conventional mounting substrate such as a board/PCB for providing next level/external connections for a BGA package (Col. 4, line 25-30; Col. 5, line 55).

It would have been obvious to a person of ordinary skill in the art at the time invention was made to incorporate a portion of the second surface is plated with a metal comprising a solder material to facilitate an attachment to a PCB as taught by Higgins, III ('377 and '062 patents) so that the thermal conduction, bonding strength and the external connection capability can be improved in Nakashima et al's BGA.

Regarding claim 80, Nakashima et al., Higgins, III ('377 patent) and Higgins, III ('062 patent) teach substantially the entire claimed structure as applied to claim 14 above, wherein Nakashima et al. teach the metal plate/stiffener substantially covering the first surface of the substrate/TAB substrate (see Fig. 21).

9. Claim 21 and 81 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nakashima et al. (US Pat. 5717252) Higgins, III (US Pat. 5583377) and Higgins III (US Pat. 5291062) as applied to claims 14 and 20 above, and further in view of Karnezos (US Pat. 6020637).

Regarding claim 21, Nakashima et al., Higgins, III ('377 patent) and Higgins III ('062 patent) teach substantially the entire claimed structure as applied to claims 14 and 20

above, except the IC die having a surface including at least one ground pad and a wire bond couples each of the ground signal pad to the first surface of the stiffener.

Karnezos teaches a BGA package where an IC having a plurality of bonding wires (12 and 2626'/26" in Fig. 2) and die pads including power and ground pads (not numerically referenced in Fig. 2) are coupled to a stiffener/heat spreader (10 in Fig. 2) such that a bonding wire corresponding to a ground ring connection on the first surface of the stiffener/heat spreader is coupled to respective die pad/ground pad (26"/21 in Fig. 2; Col. 2, line 30-40) while additional wire bonds (26' in Fig. 2) are being used to provide the desired signal/power connections for the corresponding die pads to the substrate (Col. 2, lines 17-52).

It would have been obvious to a person of ordinary skill in the art at the time invention was made to incorporate the IC die having a surface including at least one ground pad and a wire bond couples each of the ground signal pad to the first surface of the stiffener as taught by Karnezos so that the power/ground routing and thermal dissipation can be improved in Higgins, III ('377 and '062 patents) and Nakashima et al's BGA package.

Regarding claim 81, Nakashima et al., Higgins, III ('377 patent) and Higgins, III ('062 patent) teach substantially the entire claimed structure as applied to claims 14 and 80 above, except the outer edges of the stiffener being substantially even with those of the substrate.

Karnezos teaches a BGA package configuration having an IC die (12 in Fig. 2) being mounted on the heat spreader/stiffener-tape substrate (10 and 16/25 in Fig. 2 respectively) assembly where outer edges of the heat spreader/stiffener are substantially even with those of the tape substrate (Col. 2, lines 17-52).

It would have been obvious to a person of ordinary skill in the art at the time invention was made to incorporate the outer edges of the stiffener being substantially even with those of the as taught by Karnezos so that an exterior surface protection and resin molding/encapsulation can be improved in Higgins ('377 and '062 patents) and Nakashima et al's BGA package.

Response to Arguments

10. Applicant's arguments with respect to claims 14, 18-22, 60 and 63-87 have been considered but are moot in view of the new ground(s) of rejection.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Nitin Parekh whose telephone number is 703-305-3410. The examiner can normally be reached on 09:00AM-05:30PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Tom Thomas can be reached on 703-308-2772. The fax phone numbers for the organization where this application or proceeding is assigned are

703-308-7722 for regular communications and 703-308-7722 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-306-3431.

Nitin Parekh

Nitin Parekh

PATENT EXAMINER

TECHNOLOGY CENTER 2800

NP

09-08-03